

feel certain that no one who has had experience in work of this character will for a moment question whether this percentage of food, which is conferring a benefit upon agriculture, balances the injury that is inflicted upon an inexhaustible and ever-increasing fish supply.

Very similar figures might be advanced for the remaining species, none of which are taking more than 20 per cent. of fish per annum of their total bulk of food. Is the sea so impoverished that we cannot afford these birds this amount of fish-food in exchange for their beneficial action in destroying more than 20 per cent. of injurious insects (of which 7.2 per cent. consist of wireworms in the case of the black-headed gull)?

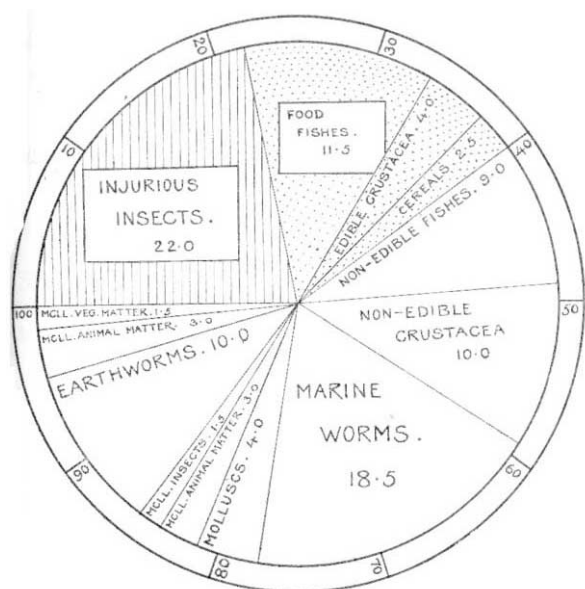


FIG. 1.—Diagrammatic representation of the percentage of food of the black-headed gull. The portions shaded by longitudinal lines represent food that it is beneficial the birds should eat; those stippled, food that it is injurious they should eat, and the blank portions food of a neutral nature.

The records, both individually and collectively, show that the bulk of the food of these birds is not fish, but animal matter of a neutral nature. Of course, if one classes all annelids, non-edible crustacea, and molluscs as fish food, then very different figures may be obtained; but those who are acquainted with the abundance and the nature of the marine life cast up on the shore will agree with us in regarding these as a neutral factor.

If the figures are summarised for all the species in class (iii) (so far as our investigation has gone),

the verdict is certainly in favour of these birds. It is very easy to condemn a species because at some particular season of the year or in some district a certain number have been found to be feeding upon food fishes; but, as has been frequently pointed out, such partial records do not give a true estimate of the food as a whole. It must not for one moment be thought that we are endeavouring to explain away the injuries inflicted, but we contend that it is unfair to judge any species of wild bird upon a local or partial record; the nature of the food generally throughout the United Kingdom and over the whole year is what we have endeavoured to learn.

Very interesting results have been obtained as to the seasonal changes of food and the variations in different localities. Sex and age also influence the quantity of food taken, and although the figures are yet incomplete, they point to the fact that the males take a larger quantity of food than the females, and the young birds more than the old.

It is not within the province of this inquiry to discuss the question of the impoverishment of the sea, but it will be impossible to conclude it without taking cognisance of the leading views on the subject and their bearing upon this question.

Finally, all the work goes to show that with a few exceptions—e.g. the cormorant and the shag—the food of each species is partly beneficial, and, even if for the moment we admit that the percentage of the fish destroyed is an injury, we must take into consideration the benefits derived by reason of the nature of the remaining food. This varies in different seasons of the year and according to the nature of the locality, but if an average is taken of the eleven species in class (iii), we find that the total percentage of injuries is less than that of the benefits, and that the bulk of the food is of a neutral nature.

It is obvious that, after examining upwards of three thousand specimens, with the results obtained, the question of the food of our commoner sea-birds and their effect upon the fisheries and agriculture can no longer remain where it was; and, whilst not advocating any special protection, except in one or two cases, any agitation for their destruction cannot be condemned too forcibly, for, altogether apart from sentimental reasons, it is extremely unlikely that our fisheries would benefit or show any marked improvement, even were hundreds of thousands of these birds destroyed annually, whilst agriculture would certainly be the sufferer by such a loss.

The Imperial College of Science and Technology.

THE Chancellor of the Exchequer, speaking in the House of Commons on March 16, expressed concern at the extraordinary expansion of business in the promotion of companies, and said he was convinced that the time had come when part of the money thus called for only creates increased competition for the limited

supplies of labour and material which are all that are available. Few of us can doubt that this concern of the Chancellor is more than justified, but it is not only for purely industrial enterprise that appeals to the public at large are being made daily for large sums of money. Owing to the universal rise in prices, educational institutions

find themselves seriously handicapped in their endeavours to fulfil the functions assigned to them. In the case of such educational institutions as the schools and colleges maintained wholly, or almost wholly, from rates and taxes, the solution is less difficult, and may be found in an increased education rate combined with an increased Government grant. For the universities which have to depend largely upon fees and endowment, and can rely only partly on Government grants, the difficulties created are very serious. It should, however, be borne in mind that money expended on education is one of the most productive forms of national expenditure, and, whatever may be the dangers of the inflation of industrial capital, the nation is not yet within remote danger of educational inflation. Rather is it suffering grievous detriment from the semi-starvation of its higher educational institutions.

Among the higher educational institutions which are in need of financial help, the Imperial College of Science and Technology holds a prominent place, and an appeal issued some months ago by the governing body makes clear the magnitude and urgency of this want. The Imperial College of Science and Technology was incorporated under Royal Charter in July, 1907, and was established "to give the highest specialised instruction and to provide the fullest equipment for the most advanced training and research in various branches of science, especially in its application to industry." The governing body was also required to carry on the work of the Royal College of Science, the Royal School of Mines, and the City and Guilds (Engineering) College, institutions previously existing, but which in 1907 became associated as integral parts of the new institution.

The Imperial College is thus an association or federation of colleges, deliberately charged by the terms of its charter to afford facilities for the highest work in pure and applied science, especially in its application to industry. As an indication of the magnitude of its work, it may be noted that in the year 1907-8 there were 665 students, including 20 engaged on post-graduate work, and the annual expenditure on maintenance approximated to 50,000*l.* In the year 1913-14—the year before the war—the number of students was 943, including 185 engaged on post-graduate work, and the annual expenditure on maintenance approximated to 90,000*l.* During the war the numbers of students were reduced by about two-thirds, but in May last year there were 841, including 110 post-graduates, and as the numbers are rapidly increasing there is every indication that the college will soon be busier than ever before. On the basis only of the pre-war annual expenditure, the Imperial College is as large as Manchester University, larger than Liverpool University, and twice as large as Bristol University. Its rank in science and technology, whether viewed from the range and standard of its teaching and research,

or from its equipment, is at least as high as that of any existing university in Great Britain.

In order that the college may rise to the height of its responsibilities and fulfil the functions assigned to it by its charter, the governing body estimates that for new buildings and equipment at least 600,000*l.* is required, and for the adequate development of the work of the college a further annual income approximating to 100,000*l.* The capitalised value of the total additional requirement has been put in round figures at more than 2,000,000*l.* It is large, but much less than the amount required for a modern battleship, and is not incommensurate with the importance to the nation and the Empire of the work which the college has to do.

From a quarter to one-fifth of the total number of students are carrying on original investigations under the direction of their respective professors, and this, together with the research work of the staff, results in considerable additions to knowledge annually. The investigations range over a wide area of science, especially in its application to industry. The contributions thus made to increased industrial efficiency are no mean factor in the national development and prosperity. At the same time, in the course of these investigations the relevant researches in pure science are not neglected, and thus much is done continually to widen the bounds of knowledge as knowledge.

The teaching work carried on in the college may be divided into (a) associateship and (b) post-associateship. The former consists of courses, approximately of honours graduate standard, leading respectively to associateships of the Royal College of Science (A.R.C.S.), the Royal School of Mines (A.R.S.M.), and the City and Guilds Institute (A.C.G.I.); and the latter of courses of study and of research, comparable in standard with M.Sc. and D.Sc. work, leading to the diploma of membership of the Imperial College (D.I.C.).

Styled "Imperial" from the first, the college has constantly to bear in mind the growing industrial needs not only of the Kingdom, but also of the Empire, and to do this it must possess a flexibility and an adaptability suitable to the ever-changing conditions of industry. To take one example, the war disclosed, as in a flash, the perilous condition of the optical glass and optical instrument industry in this country through the dependence for many years on foreign supplies, particularly from Germany. A new department of technical optics has been established by the governors of the Imperial College, which, by research, by the supply of trained technologists in this field, and by the education of the users of optical instruments, must go far to second the efforts of the manufacturers to build up and stabilise this important and essential national industry. At no time was the need for an intensive and extensive development of science, both pure and applied, more needed than at the present time of national reconstruction after five

years of a devastating world war, and in this task of extending our knowledge of pure science and its application to the whole field of industry the Imperial College is called upon to play a vital and predominant part.

The recognition of how great and important are the responsibilities thus cast upon the Imperial College has led to a movement for obtaining for the college the status of a university with the power to confer degrees in its own subjects or faculties. The movement is backed by the unanimous support of the rector and professors of the

Imperial College, and it is supported, so far as can be ascertained in any organised way, by the overwhelming majority of the past and present students of the college. The issue raises, no doubt, questions that are novel and complicated in relation to university education in general and to the University of London in particular. Nothing but good can come from a free and frank examination of the proposition in all its bearings, undisturbed and unprejudiced by lesser interests than that of increasing the efficiency of university education and especially of scientific education.

Magnetic Disturbances and Geological Structure.¹

THE research described in the report before us was undertaken at the instigation of the Iron Ores Committee of the Conjoint Board of Scientific Societies. Certain lines and centres of magnetic disturbance had been noted in Britain so long ago as 1890 by Rücker and Thorpe, and a new magnetic survey by Mr. G. W. Walker in the years 1914 and 1915 confirmed the existence of these disturbed areas. It is well known that iron is the only element which gives rise to magnetic effects of considerable intensity, and it was therefore of importance to determine whether any relationship could be established between the location of these disturbances and the distribution of iron ores.

The detailed magnetic survey of (1) the proved sheet of iron ore, mainly in the state of ferrous carbonate, round Irthlingborough, and (2) the known areas of magnetic disturbance about Melton Mowbray, was therefore undertaken by Mr. Walker. At the same time, Dr. Cox reviewed the geology of the areas and collected specimens of rocks which promised to afford evidence in the matter, while the magnetic susceptibilities of these materials were determined by Prof. Ernest Wilson.

The results of the magnetic and petrological examination of the rocks confirm the opinion that the magnetic susceptibility of rocks depends scarcely at all upon the percentage of metallic iron they contain, but upon the condition—i.e. state of oxidation—of that iron; and that, although rocks composed of ferrous compounds show higher susceptibilities than those constituted of fully oxidised ferric compounds, only those rocks in which the iron occurs as the mineral magnetite have notable magnetic susceptibility. It was shown that parts of the granite of Mount Sorrel have a susceptibility more than four times as great as that of the most magnetic of the local Jurassic iron ores, and ten to fifteen times as great as certain basic igneous rocks, which, though high in iron, contain no appreciable amount of magnetite.

Another point of some interest is the variability of magnetic properties shown by samples taken from one continuous rock mass. The outer part

of the dolerite sill proved in the Owthorpe borehole was a fine-grained rock having a glassy base; its iron ore occurs as magnetite, and the magnetic susceptibility of the specimen examined was 472×10^{-5} C.G.S. units. The coarse-grained rock from the centre of the intrusion, however, in which the iron ores crystallised as ilmenite, gave a susceptibility of only 10.3×10^{-5} C.G.S. units. A like low susceptibility was noted also in the basalt from the Southwell borehole.

The magnetic phenomena of the Irthlingborough district are adequately explained by the presence of such a large, flat-lying sheet of feebly magnetic rock as the Bajocian iron-ore bed, but in the Melton Mowbray district the proved limits of the marlstone iron-ore bed bear no relation to the observed magnetic phenomena. Moreover, the consideration of the magnetic irregularities obtained in the Melton Mowbray district shows that the source of the disturbance cannot be less than 3000 ft., and may be as much as 10,000 ft. beneath the surface. The only rocks in this region which have the requisite magnetic susceptibility and may be expected to occur at these depths are dolerites, such as are found intrusive into the Coal Measures throughout the Midland coalfield area, or possibly granites like those which have invaded the old pre-Carboniferous rocks in Charnwood Forest.

Mr. Walker's observations show that, near to Melton Mowbray, there are two main magnetic disturbances, and that the line joining them ranges north of west and south of east from Melton Mowbray towards Rempstone, passing a little south of the latter place. This line agrees with that of a known fault of small throw which cuts the Mesozoic rocks, and may be expected to have a much larger throw in the Palæozoic and older strata underground. Similar magnetic disturbances are noted near certain large faults in the Nottingham district. Rücker and Thorpe showed that magnetic disturbances are always to be expected where a sill or dyke of highly susceptible rock is displaced by a fault, and that, if any rock containing magnetite is intruded as a dyke among non-susceptible rocks, similar magnetic disturbances must occur. It is known that in many districts the place of intrusions has been determined by faulting, and it is pointed out by Dr. Cox that the concealed coalfield of Notting-

¹ "A Report on Magnetic Disturbances in Northamptonshire and Leicestershire and their Relations to the Geological Structure." By Dr. A. H. Cox. Phil. Trans. Roy. Soc., Series A, vol. ccxix., pp. 73-135; plates Ap. i.-Ap. iii.